

REMARKS

The last Office Action has been carefully considered.

It is noted that claims 1 and 6 are rejected under 35 U.S.C. 103 over the patent to Singh in view of the patent to McAdams.

Claims 2-4 and 6 are rejected under 35 U.S.C. 103 over the patents to Singh, and McAdams and general knowledge, and further in view of the patent to Cresswell.

Claim 5 is rejected under 35 U.S.C. 103(a) over the patent to Singh, McAdams and general knowledge in the art and further in view of Honerkanp.

Also, the abstract, the specification, the drawings, and the claims are objected to and the claims were rejected under 35 U.S.C. 103.

In connection with the Examiner's formal objections and rejections, applicant has provided a new abstract of the disclosure, corrected the specification, submitted a copy of the corrected drawings, and corrected

the claims. It is believed that all grounds for formal objections and rejections are therefore eliminated.

After carefully considering the Examiner's grounds for the rejection of the claims over the art, applicant wishes to make the following remarks.

Examiner Page 8/1-4

...localizing the edge of the test object on the image of each line of scanning and (g) producing and storing a set of values of a coordinate $X(i)$ which correspond to a position of the edge of an i -th line of scanning, as recited by Singh et al in Col. 3/11.18-22 and Col. 8/11.14-17.

Singh et al Col. 3/11.18-22

The measurement of a calibration standard reference sample typically involves determining where an edge of the sample is. At the sub-micron range, an edge of a sample may be a complex waveform, as opposed to a flat line. Therefore, in measuring the sample, assumptions must be made as to edge location, which lead to errors.

Singh et al Col. 8/11, 14-17

The processing system 44, in addition to processing data received by the detection system 38, synchronizes the scanning of the display 40 with electron beam scanning of the wafer 26 to provide the image.

Present invention Singh et al does not localize the edge of the test object for each line of scanning and does not produce a set of values of coordinates of the edge for each line of scanning.

Examiner, page 8/4-5

...approximating the set of values $X(i)$ with a straight line, as specifically recited by Singh et al in Col. 4/11.17-21 & 57-62.

Singh, et al: Col. 4/11.1 1-21

According to another aspect of the present invention, one or more correlation curves may be generated from the reference sample SEM measurements for analysis in calibrating the SEM. The curves may comprise measured line width or pitch verses actual line width or pitch, or even actual or measured width versus actual or measured pitch. In this way, the correlation may utilize curve fitting, stochastics, neural networks, artificial intelligence, data fusion techniques, trending and the like, to account for

variations in reference sample feature dimensions in determining one or more calibration factors for the SEM.

Singh, et al: Col. 4/11.52-62

The method further comprises correlating at least one of the first line width measurement and the first pitch measurement with at least one of the second line width measurement and the second pitch measurement to obtain at least one calibration factor. The correlation may comprise one or more of computing the slope of a curve, computing a zero offset, computing a calibration coefficient, curve fitting stochastics, neural networks, artificial intelligence, data fusion techniques, and trending, in order to calibrate the SEM.

Applicant submits that Singh, et al does not approximate the set of values $X(I)$ [versus I] with a straight line, i.e. edge position versus number of line of scan. Singh, et al does not produce the set of values $X(I)$ and therefore can not approximate it.

Examiner Page 8/5-8

...and calculating deviations $\Delta(I)$ of coordinates $X(I)$ from a straight line on each line of scanning as implicated by Singh's in Col. 4/11.5-

21 & 43-63, Col. 9/11.54-61, Col. 11/11.21-28, Col. 16/11.1-27, and conventionally practiced by those generally skilled in the art.

Singh, et al: Col. 4/11.2-21

The method and system eliminate or minimize the effects of reference feature dimension variations, allowing such deviations to be detected and accounted for in the calibration of a SEM. In this regard, the correlation of the reference feature dimensions may comprise one or more of computing the slope of a curve, computing a zero offset, computing a calibration coefficient, curve fitting, stochastics, neural networks, artificial intelligence, data fusion techniques, and/or trending, according to another aspect of the invention.

Applicant submits that in the present invention reference feature does not have dimension variations (feature with known straight edge), therefore our method does not need the correlation of the reference feature dimensions.

Singh, et al: Col. 4/11.43-63

In accordance with still another aspect of the invention, there is provided a method for calibrating a scanning electron microscope,

comprising providing a reference sample having a first line set with generally parallel lines of a first line width and a first pitch, and a second line set with generally parallel lines of a second line width and a second pitch, measuring at least one of the first line width and the first pitch using the scanning electron microscope, and measuring at least one of the second line width and the second pitch using the scanning electron microscope. The method further comprises correlating at least one of the first line width measurement and the first pitch measurement with at least one of the second line width measurement and the second pitch measurement to obtain at least one calibration factor. The correlation may comprise one or more of computing the slope of a curve, computing a zero offset, computing a calibration coefficient, curve fitting, stochastics, neural networks, artificial intelligence, data fusion techniques, and trending, in order to calibrate the SEM.

Singh: Col. 9/11.51-61

In addition to the programs and instructions for carrying out SEM measurements, the processing system 144 is adapted to receive and analyze data (not shown) relating to pitch and/or line width measurements of various features 162 on the reference sample 150. In this regard, the processing system 144 and/or the memory 146 may include programs and instructions for performing various mathematical algorithms, such as for

example, computation of one or more calibration or scaling factors, stochastics neural networks, artificial intelligence, data fusion techniques, and the like.

Singh et al: Col. 1.1/11.21-28

Moreover, it will be recognized that many algorithms and correlation techniques are available to compensate for reference sample feature degradation, variation, and other errors in the system 100, for example, computing calibration scaling factors, curve fitting, stochastics, neural networks, artificial intelligence, data fusion techniques, mathematical prediction/correction techniques, and the like.

Applicant submits that

system 100="a system and method for calibrating a scanning electron microscope in accordance with the present invention" - Scheme of SEM.

Singh et al does not calculate deviations of coordinates in the position of the edge from a straight line on each line of scanning to determine errors associated with mutual influence of a "fast" line scanning (X-scanning) and "slow" frame scanning (Y-scanning).

Singh et al: Col. 16/11.1-27

Many different correlations are possible, all of which are not illustrated herein. However, it will be appreciated that a wide variety of correlation techniques are within the scope of the invention, comprising one or more of computing the slope of a curve, computing a zero offset, computing a calibration coefficient, curve fitting, stochastics, neural networks, artificial intelligence, data fusion techniques, and/or trending. In addition, many different correlations are possible, based on measurements of features on different reference samples, some of which are illustrated in Figs. 4-10.

Although the invention has been shown and described with respect to a certain embodiments, it will be appreciated that equivalent alterations and modifications will occur to others skilled in the art upon the reading and understanding of this specification and the annexed drawings. In particular regard to the various functions performed by the above described components (assemblies, devices, circuits, systems, etc.), the terms (including a reference to a "means") used to describe such components are intended to correspond, unless otherwise indicated, to any component which performs the specified function of the described component (i.e., that is functionally equivalent), even though not structurally equivalent to the disclosed structure, which performs the function in the

herein illustrated exemplary embodiments of the invention. In this regard, it will also be recognized that the invention includes a system for performing the steps of the various methods of the invention.

Cresswell et al (USPAT 5,920,067)

Applicant submits that

Cresswell et al invention describes a method for forming reference object (this reference object can be used in our invention), and using this reference. But neither Cresswell nor Singh does not describe a method for determination of errors associated with mutual influence of a “fast” line scanning (X-scanning) and “slow” frame scanning (Y-scanning).

They do not calculate the position of the edge on the line of scan of the SEM image, they do not approximate the edge positions with the line, and they do not calculate deviations of edge positions from the straight line.

In view of the above presented remarks it is believed to be clear that none of the references teaches localizing an edge of the test object of the image of each line of scanning, none of the references teaches producing and storing a set of values of a coordinate which corresponds to

a position of the edge of an i-th line of scanning, none of the references teaches approximating such set of values with a straight line, none of the references teaches calculating deviations of the coordinates from the straight line on each line of scanning, and none of the references finally teaches analyzing the set of values of the deviations on each line of scanning, and making conclusions based on the above.

When the method is performed in accordance with the present invention, it is possible to obtain a significantly more accurate judgment whether or not the scanning electron microscope can be used for measurements and whether or not an adjustment is needed.

It is therefore believed to be clear that the new features of the present invention as defined now in amended claim 1 are not disclosed in the references, and the references do not contain any hint or suggestion that such features can be or must be produced in them.

In order to arrive at the applicant's invention from the references, the solutions disclosed in the references have to be fundamentally modified, in particular by redesigning the methods and including into them the features of the present invention. However, it is

known that in order to arrive at a claimed invention, by modifying the references the cited art must itself contain a suggestion for such a modification.

This principle has been consistently upheld by the U.S. Court of Customs and Patent Appeals which, for example, held in its decision in re Randol and Redford (165 USPQ 586) that

Prior patents are references only for what they clearly disclose or suggest; it is not a proper use of a patent as a reference to modify its structure to one which prior art references do not suggest.

Definitely, the references do not contain any hint or suggestion for such modifications.

Also, as explained herein above, the present invention provides for highly advantageous results which can not be accomplished by the solutions disclosed in the references. It is well known that in order to support a valid rejection the art must also suggest that it would accomplish applicant's results. This was stated by the Patent Office Board of Appeals, in the case Ex parte Tanaka, Marushima and Takahashi (174 USPQ 38), as follows:


Claims are not rejected on the ground that it would be obvious to one of ordinary skill in the art to rewire prior art devices in order to accomplish applicants' result, since there is no suggestion in prior art that such a result could be accomplished by so modifying prior art devices.

In view of the above presented remarks and amendments, it is believed that claim 1 should be considered as patentably distinguishing over the art and should be allowed. As for the dependent claims, these claims depend on claim 1, they share its presumably allowable features, and therefore it is respectfully submitted that they should be allowed as well.

Reconsideration and allowance of the present application is most respectfully requested.

Should the Examiner require or consider it advisable that the specification, claims and/or drawings be further amended or corrected in formal respects in order to place this case in condition for final allowance, then it is respectfully requested that such amendments or corrections be carried out by Examiner's Amendment, and the case be passed to issue. Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, he is invited to telephone the undersigned (at 631-243-3818).

Respectfully submitted,



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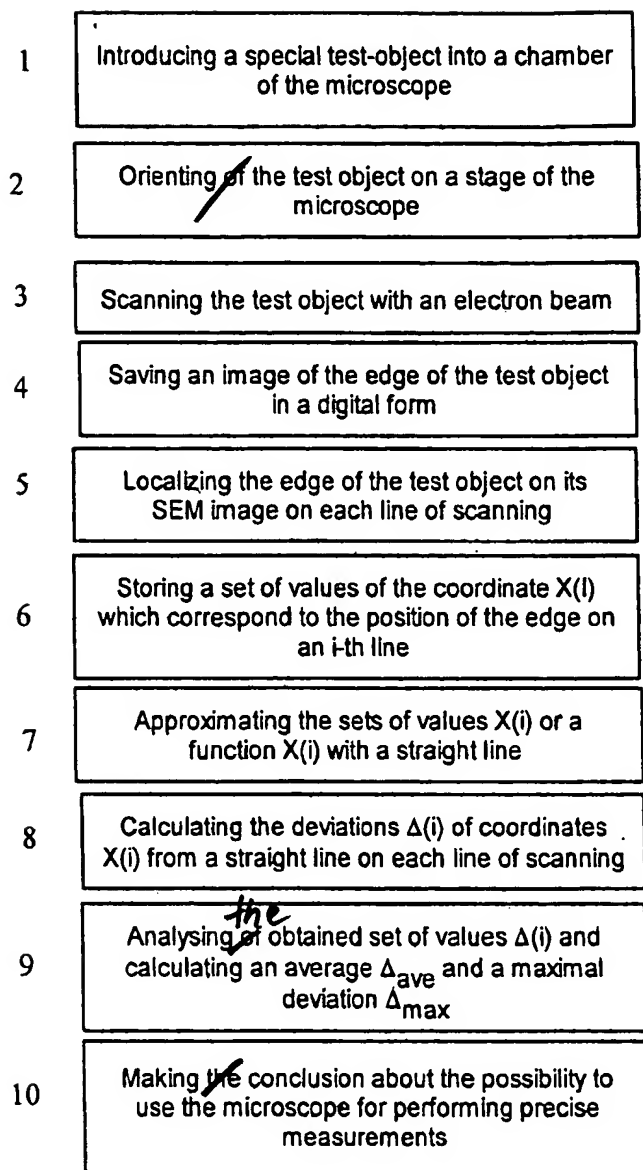


Figure 2.

Flow chart of the actions according to invention. ^{the}